

TABLE 4.—Observations by means of kites, captive and limited height sounding balloons during December, 1930

	Broken Arrow, Okla.	Due West, S. C.	Ellendale, N. Dak.	Groesbeck, Tex.	Royal Center, Ind.
Mean altitudes, (meters) m. s. l., reached during month.....	2,839	2,193	2,649	2,184	2,687
Maximum altitude (meters), m. s. l., reached.....	4,212	4,588	4,794	3,397	4,588
Number of flights made.....	30	32	32	23	29
Number of days on which flights were made.....	29	31	29	23	28

In addition to the above there were approximately 176 pilot balloon observations made daily at 60 Weather Bureau stations in the United States.

## AEROLOGICAL OBSERVATIONS FOR THE YEAR 1930

By L. T. SAMUELS

Free-air temperatures during 1930 were slightly above normal in the northern part of the country and slightly below in the southern part. (Table 1.) There was a tendency for the negative departures to increase in magnitude with elevation.

Free-air relative humidity departures were mostly negative and of small magnitude. Negative relative humidity departures occurred with negative temperature departures at most stations and levels and this appears significant in connection with the general drought which prevailed.

Vapor pressure departures were negative except at Ellendale and in the upper levels at Broken Arrow, Due West, and Royal Center. The largest negative departures occurred at Groesbeck.

From Table 2 it is found that the total number of flights (kites, captive, and limited-height sounding balloons) made during the year at the five stations was 1,749. This is an average of 350 flights per station. The average altitude reached was 2,743 meters above sea level. The highest elevation (8,384 meters) reached during the year was that of a limited-height sounding balloon at Ellendale on September 29, 1930. In addition there were 40 sounding balloon observations made at 10 Weather Bureau stations during January and 36 at Royal Center during September, the latter being the international month.

TABLE 1. Free-air temperatures, relative humidities, and vapor pressures during year 1930

TEMPERATURE (°C.)										
Altitude meters u. s. l.	Broken Arrow, Okla. (233 meters)		Due West, S. C. (217 meters)		Ellendale, N. Dak. (444 meters)		Groesbeck, Tex. (141 meters)		Royal Center, Ind. (225 meters)	
	Mean	De- par- ture from normal	Mean	De- par- ture from normal	Mean	De- par- ture from normal	Mean	De- par- ture from normal	Mean	De- par- ture from normal
Surface.....	14.3	-1.2	15.2	-1.3	6.1	+0.5	16.2	-1.9	10.7	-0.3
500.....	14.0	-0.1	14.1	-0.6	5.9	+0.4	15.4	-0.9	9.3	+0.3
1,000.....	12.6	+0.3	12.0	-0.4	5.0	+0.4	14.1	-0.6	7.1	+0.3
1,500.....	10.6	+0.1	9.5	-0.5	3.5	+0.3	12.2	-0.8	4.7	-0.1
2,000.....	8.2	-0.1	6.8	-0.8	1.4	+0.4	10.0	-0.9	2.6	-0.1
2,500.....	5.5	-0.2	4.2	-0.9	-1.2	+0.4	7.4	-1.1	0.2	-0.2
3,000.....	2.6	-0.3	1.6	-0.9	-3.9	+0.5	4.8	-1.1	-2.3	-0.2
4,000.....	-3.8	-1.0	-3.8	-0.8	-9.9	+0.1	-0.8	-1.2	-8.2	-0.9
5,000.....	-9.6	-1.2	-9.4	-0.8	-15.9	-0.2	-----	-----	-14.0	-0.7

RELATIVE HUMIDITY (%)										
Surface.....	69	+1	69	+1	70	-2	78	+4	70	0
500.....	63	-2	64	-2	70	-1	70	-1	67	-2
1,000.....	57	-4	61	-3	64	0	59	-4	64	-2
1,500.....	53	-4	59	-3	59	0	52	-3	60	-2
2,000.....	50	-3	57	-2	56	-1	48	-1	56	-2
2,500.....	48	-2	55	-1	56	0	45	0	53	-1
3,000.....	47	-2	53	0	55	0	43	+1	51	-1
4,000.....	48	+2	53	+3	55	+2	32	-7	47	-1
5,000.....	40	-3	66	+10	51	+1			42	-5

VAPOR PRESSURE (mb.)										
Surface.....	12.93	-0.83	13.58	-0.42	8.03	-0.04	16.21	-0.57	10.50	-0.28
500.....	11.70	-0.46	11.85	-0.52	7.90	+0.04	13.79	-0.88	9.20	-0.16
1,000.....	9.64	-0.33	9.71	-0.70	6.55	+0.18	10.26	-1.34	7.61	-0.14
1,500.....	7.84	-0.21	7.90	-0.71	5.42	-0.16	7.94	-1.04	6.20	-0.07
2,000.....	6.21	-0.13	6.33	-0.55	4.39	-0.08	6.23	-0.70	4.82	-0.20
2,500.....	4.88	-0.08	5.01	-0.42	3.56	-0.03	5.02	-0.46	3.74	-0.12
3,000.....	4.00	+0.07	4.04	-0.27	2.90	-0.06	4.24	-0.14	3.04	+0.01
4,000.....	2.81	+0.36	2.83	+0.02	1.75	-0.08	1.57	-1.31	1.91	+0.07
5,000.....	1.91	+0.38	2.05	+0.71	0.96	-0.22	-----	-----	1.05	-0.26

TABLE 2.—Observations by means of kites, captive and limited height sounding balloons during 1930

	Broken Arrow, Okla.	Due West, S. C.	Ellendale, N. Dak.	Groesbeck, Tex.	Royal Center, Ind.
Mean altitudes (meters), m. s. l., reached during month.....	2,793	2,644	3,004	2,327	2,940
Maximum altitude (meters), m. s. l., reached and date.....	6,397	5,789	8,384	4,485	8,201
Number of flights made.....	354	359	387	302	347
Number of days on which flights were made.....	355	337	348	278	334

<sup>1</sup> Limited height sounding balloon observation.

<sup>2</sup> Captive balloon observation (breakaway).

In addition to the above there were approximately 150 pilot balloon observations made daily at nearly 60 weather bureau stations in the United States.

## WEATHER IN THE UNITED STATES

## THE WEATHER ELEMENTS

By M. C. BENNETT

## GENERAL SUMMARY

December was mostly mild east of the Rocky Mountains and generally dry. In the west Gulf section and the Southeastern States, as far north as the Potomac and Ohio Rivers, the temperature for the month was below normal, with freezing temperatures extending into Florida, while in the central and northern regions, from the Mississippi Valley to the Rocky Mountains, abnormally high temperatures for the season prevailed; but in the Great Basin it was unusually cold. However, in the far Southwest and Pacific coast districts, near normal temperatures were the rule.

Generous amounts of precipitation were received in many places in the South Atlantic States and in eastern West Virginia, but many of the Atlantic coast districts had less than normal. From the Ohio and Missouri Valleys northward, the totals were small, with large areas receiving less than one-fourth of the normal, while in much of Texas and Oklahoma more than the normal was

received. But from the Rocky Mountains westward the month was generally dry, with considerable areas in the southern portion of the Plateau and Pacific regions receiving no appreciable precipitation.

## TEMPERATURE

While a cold snap swept quickly over the north-central and northeastern areas as the month started, yet the first half of December averaged warmer than normal over nearly the whole country, except that portions of the Atlantic States and the lower Lake region averaged slightly colder than normal, while decidedly cold weather persisted in the northern and central Plateau areas.

From the middle of the month onward warm weather persisted in the north-central portion from Wisconsin and northern Illinois to central Montana and northeastern Wyoming, and this period was slightly warmer than normal in New England and much of New York, Washington, and California. The greater part of the country, however, was cooler than normal during most of this half-month. The southeastern portion and the Plateau region showed fairly large negative departures, low temperatures prevailing in the former from the 17th to the 24th, while

southern Idaho and districts adjacent were remarkably cold throughout the final decade.

The month averaged warmer than normal in practically all northern districts, and throughout most of the Missouri Valley and the Plains. The Dakotas averaged about 7° warmer than normal; while the South Atlantic and Gulf districts averaged 3° to 5° colder, and most of Idaho and Utah from 7° to 10° or more colder. At Salt Lake City, Utah, the month was the coldest December in a record of 57 years, and some stations on the east Gulf coast had about the coldest December of record.

In departure of mean temperature, November and December of 1930 were surprisingly alike. The most notable differences were in the Dakotas and the eastern portions of the States next westward, where November had been only slightly warmer than normal, but the following month brought a marked excess of temperature, and from Mississippi northeastward over the Ohio Valley to western New York, where November had been warmer than normal, but December was colder.

The highest temperatures occurred usually between the 8th and 11th, save in some Atlantic States on the 1st. The lowest temperatures showed less uniformity in time of occurrence, but were reached mainly between the 15th and 27th. As a rule, the temperature extremes were not noteworthy, but in Nebraska this was the first December in a record of 55 years when not one station recorded a temperature of zero or below.

#### PRECIPITATION

In eastern and south-central districts the precipitation came largely during the first and last weeks, save that parts of the South Atlantic States had considerable rain or snow about the 17th. The second week was the time of greatest precipitation in the far Northwest.

December, for the country as a whole, was a month of scanty precipitation, especially from California eastward and northeastward to the middle and northern portions of the Rocky Mountain and Plains regions, and to a considerable extent still farther eastward in the upper Mississippi Valley, the upper Lake region, and the States just north of the Ohio River. In the Pacific Northwest there was mainly less than half of the normal precipita-

tion. Oklahoma, with most of western and north-central Texas, had more than normal rainfall, owing chiefly to the rains of the first week. However, the Gulf States, the Appalachian region, and the Northeast usually had about two-thirds to four-fifths of the normal amounts, but much of the South Atlantic region had more than normal, especially central Florida and the eastern parts of the Carolinas.

#### SNOWFALL

The snowfall of December was less than normal in nearly all districts west of the Appalachian Mountains, and was particularly scanty from California northeastward to southern Minnesota and central and northern Wisconsin. Northern and western Oklahoma and many adjacent districts had about as much snow as normal, likewise part of eastern Iowa; also from the western end of Lake Superior to north-central North Dakota the amounts were seasonable.

From central Pennsylvania southward practically all the Appalachian region had considerable snowfall, some portions having decidedly large amounts compared with what December usually brings. Nearly all of Tennessee had moderate snowfall, and north-central North Carolina and southern Virginia comparatively large amounts. New York and Vermont had mainly somewhat less snow than normal, but interior New England elsewhere more than normal.

#### SUNSHINE AND RELATIVE HUMIDITY

Much cloudy weather prevailed throughout the East and as far westward as the Mississippi Valley, in the west Gulf States, and the northern portion of the Pacific and Plateau regions, while in the south Pacific region much sunshiny weather prevailed. Elsewhere, about the normal amount of sunshine for December was received. The relative humidity was generally near or slightly above the normal over much of the country east of the Rocky Mountains, notwithstanding the fact that there was a general deficiency of precipitation in most sections. However, from the Rocky Mountains westward, except in the Great Basin, it was generally below the average for the month.

#### SEVERE LOCAL STORMS, DECEMBER, 1930

[The table herewith contains such data as have been received concerning severe local storms that occurred during the month. A more complete statement will appear in the Annual Report of the Chief of Bureau]

Place	Date	Time	Width of path, yards	Loss of life	Value of property destroyed	Character of storm	Remarks	Authority
Port Huron, Mich.....	15					Heavy snow.....	Traffic of all kinds delayed.....	Official, U. S. Weather Bureau.
Goldsboro, N. C., and vicinity.	17					Snow and sleet.....	Some damage, character not reported.....	Do.
Wichita, Kans.....	17					Glaze.....	Number of serious auto accidents.....	Do.
Nantucket, Mass.....	27	3:30 p. m.				Gale.....	High tide caused considerable damage to small boats and the water front.	Do.
Marquette, Mich.....	29-31					Snow and wind.....	Outdoor activities hampered; auto and railway transportation tied up; wind very severe at times.	Do.